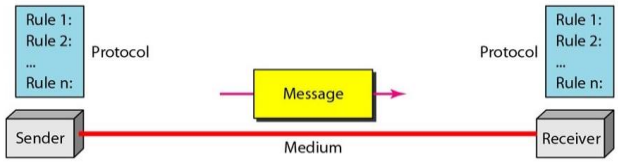
Components of data communications.



Message
The message is the information (data) to be communicated. Different types of data include text, numbers, pictures, audio, and video.

Sender
The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.

Receiver
The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.

Transmission medium
The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves

Protocol
A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices.

Data Flow

Simplex
In simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit; the other can only receive .

Keyboards and traditional monitors are examples of simplex devices.

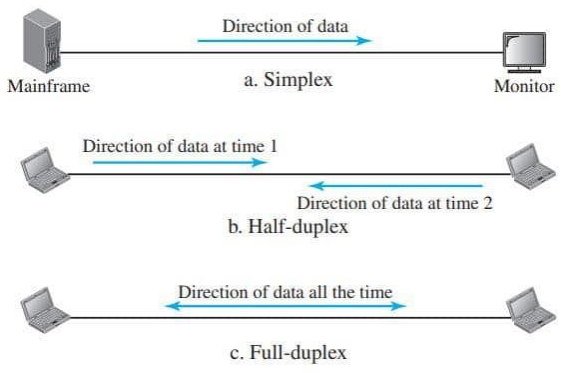
Half-Duplex
In half-duplex mode, each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive, and vice versa

Walkie-talkie is an example of half-duplex systems.

Full-Duplex

In full-duplex both stations can transmit and receive simultaneously. The full-duplex mode is used when communication in both directions is required all the time.

Example of full-duplex communication is telephone network. When two people are communicating by a telephone line, both can talk and listen at the same time.



Layered Architecture

OSI network model uses a layered architecture. In general each layer gives services to the next upper layers. For example layer 2 (data link layer) gives services to layer 3(Network Layer).

In sender machine each layer appends Header with data and feed it to the next lower layer. For example Network layer(Layer 3) appends IP address as a header and feed it to layer 2. Next, Layer 2 gets the whole data block (Data and network layer header) considering it as only data (not aware of header added previously) and adds corresponding header and feed it to layer 1. This process of adding header is called **Encapsulation**.

In layer 1 the data along with all the headers added by all upper layer converted to bit stream and transmitted through transmission medium as electrical signal. In receiver machine the bit stream is received by its physical layer and the bit stream goes up to different layers sequentially. At each layer in the receiver machine it removes corresponding header from the data block and feed it to next upper layers.

Physical Layer

The physical layer coordinates the functions required to carry a bit stream over a physical medium. It deals with the mechanical and electrical specifications of the interface and transmission medium.

Responsibility

Physical characteristics of interfaces and medium

Representation of bits.

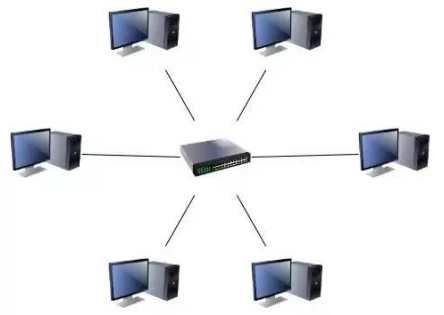
Data rate -the number of bits sent per second is defined by the physical layer
.
Synchronization of bits.-The sender and receiver not only must use the same bit rate but also must be synchronized at the bit level.

Physical topology- The physical topology defines how devices are connected to make a network.

Transmission mode The physical layer also defines the direction of transmission between two devices: simplex, half-duplex, or full-duplex.

Data Link Layer

The Data link layer is responsible for the delivery of frame within same networks.



Responsibility

Framing- The data link layer divides the stream of bits received from the network layer into data units called frames.

Physical addressing – It append physical address of destination as a header.

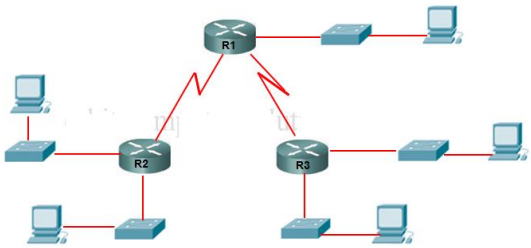
Flow control- If the rate at which the data are absorbed by the receiver is less than the rate at which data are produced in the sender, the data link layer imposes a flow control mechanism to avoid overwhelming the receiver.

Error control- The data link layer adds mechanisms to detect and retransmit damaged or lost frames

Access control- It determines which device has control over the link at any given time.

Network Layer

The network layer is responsible for the source-to-destination delivery of a packet, possibly across multiple networks.



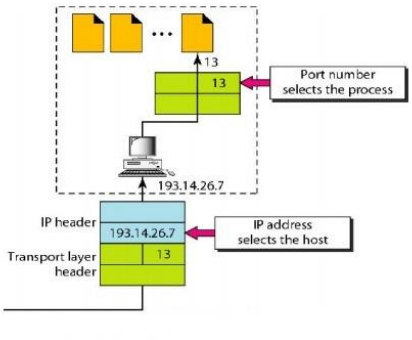
Responsibility

Logical addressing - The physical addressing implemented by the data link layer handles the addressing problem locally(within same network). If a packet passes the network boundary, we need logical addressing.

Routing - It uses special intermediate device called router to rout packet from one specific network to other.

Transport Layer

A process is an application program running on a host. The transport layer is responsible for process-to-process delivery of the entire message.



Port Addressing – It uses port address for identifying a specific process or service for process to process communication.

Connection control. The transport layer can be either connectionless or connection oriented.

Flow control. Like the data link layer, the transport layer is responsible for flow control. However, flow control at this layer is performed end to end rather than across a single link.

Error control. Like the data link layer, the transport layer is responsible for error control. However, error control at this layer is performed process-to process rather than across a single link.

Presentation Layer

The presentation layer is concerned with the syntax and semantics of the information exchanged between two systems.

Translation Because different computers use different encoding systems (data presentation style), The presentation layer at the sender changes the information from its sender-dependent format into a common format. The presentation layer at the receiving machine changes the common format into its receiver-dependent format.

Encryption - Encryption means that the sender transforms the original information to another form and sends the resulting message out over the network. Decryption reverses the original process to transform the message back to its original form.

Compression Data compression reduces the number of bits contained in the information.

Application Layer

It provides user interfaces and support for services such as electronic mail, remote file access and transfer, shared database management, and other types of distributed information services.

Network virtual terminal A network virtual terminal is a software version of a physical terminal, and it allows a user to log on to a remote host

File transfer, access, and management. This application allows a user to access files in a remote host (to make changes or read data), to retrieve files from a remote computer for use in the local computer.

Mail services. This application provides the basis for e-mail forwarding and storage.

TCP/IP PROTOCOL SUITE

OSI network model is an ideal and theoretical model. OSI model never implemented practically. TCP/IP is a collection of protocols named after its two most important protocols, the Transmission Control Protocol (TCP) and the Internet Protocol (IP).